Do-It-Yourself Visualization

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This exercise describes how to produce your own visualization products on the Macintosh using the Public Domain program 'IMAGE' from the National Institutes of Health, and a public domain rendering program called POVRAY.

The IMAGE program is used to select image segments for use with POVRay and to convert them to Macintosh PICT format which is then converted with Giffer to Compuserve GIF format. A recent version of Image (1.49) has been modified to read nearly all PDS format image files (8 and 16 bit images) and to display PDS images with black as the lowest sample value and white as the highest. As distributed by NIH the program displays low sample values as white and high values as black (like X-rays). This modified version of the program is available for Anonymous FTP transfer on Starhawk in the file IMAGE4PDS.HQX in the \pub directory or on SPAN node JPLPDS:: in the directory: DISK$USER1:[IMDISP.MACII]. After downloading, the file must be converted from BINHEX to STUFFIT format then extracted from the IMAGE4PDS.SIT STUFFIT archive.

POVRAY is a public domain modelling and rendering program which is available on Compuserve in the Graphics forum. It runs on either a Macintosh or PC. It has two important features for producing visualization products. First, it can import a GIF format file and interpret it as elevation information to build a 3-D model. Second, it can import another GIF file and interpret it as a texture map to overlay on the 3-D model.

A good data source is the Mars Digital Terrain Map CD-ROM, (Volume VO-2007, available from the imaging node of the Planetary Data System) or the National Space Science Data System (request@ncf.gsfc.nasa.gov). This disk contains both digital image maps and terrain maps. The terrain maps are elevation measurements which have been converted to raster format and can be viewed and manipulated as images. The area covered in the examples is near the Martian south pole. It is located at 280 degrees west longitude and 75 degrees south latitude (-75), in files MG75S280.IMG and TG75S280.IMG. The area contains eroded terrain and interesting craters with fluted ridges. Figure 1 shows the area of interest in digital image format, digital terrain format (where white is higher terrain and black is lower) and also as a rendered view using a gray texture and a actual digital image as the texture.

The area covered in the images is about 230 km. The values in the digital terrain map represent elevation in meters above or below the Martian 'sea level'. Since display programs do not know how to interpret negative sample values, the elevations are scaled so they can be represented as positive integers. For the Martian terrain a scaling factor of 2 was used, and an elevation offset of 6000. Thus the actual elevation is equal to the stored value times two, minus 6000. Elevations in the mosaic from which the example image was extracted range from 3500 to 6020 in the original data, which corresponds to actual elevations of 1000 to 6000 meters. When Image loads the 16-bit

values it scales them into the range of 1 to 254. The subset image which is shown in the figures has a range of sample values from 78 to 251, or elevations from about 1600 to 5000 meters. Thus the elevation range (3.4km) is about 65 times less than the spatial range.

The area to be used in this exercise is located at x:356, y:822. With the rectangular selection tool from the image menu hold the mouse button down on this point, then move the mouse down and to the right until the x,y values in the status window show 250,250. Release the mouse and a selection rectangle should outline the area of interest. Use 'Save Section As' from the 'File' dialog box to record the image in PICT format. Do this for both the MDIM and DTM image segments. The next step is to use the Giffer program to convert the two images to GIF format. Simply open them with Giffer than use Save As with the default output file type (GIF).

Now we will use POVRAY to render the elevation data. The script southgray.pov is already set up to read a file named southtopo.gif and produce a gray view.

```
// POV control file for SOUTH

#include "colors.inc"
#include "shapes.inc"
#include "textures.inc"

#declare Bi = 2

#declare Texture = /* Gray */
texture {
   pigment { color red .500 green 0.500 blue .500 }
}

height_field {
    gif "southtopo.gif"
    smooth
    rotate <-90,0,0>              // rotate from z to x axis
    texture {Texture}             // apply texture
    translate < -0.5, -0.5, -0.5> // center the field on the axes
    scale <300.00, 300.00,75.00>  // scale z 1/4 of X and Y
    rotate <0, 0, 0>              // rotate to match previous
display
    }

camera {
   location <0.0, -900.0, -900.0>
   direction <0, 0, 5>
   look_at <0.000, 90.000, 0.000>
}

light_source {
    <-200, 0, -200.000> color White
}
```

The next step is to apply the digital image file as a texture map. Simply change the Texture declaration to be an image map instead of a pigment. The script southimage.pov has been modified to do this.:

```
#declare Texture = /* Black and white image for texture map */
texture {
  pigment {
   image_map {
      gif "southimage.gif" map_type 0 once interpolate Bi }
       }
      }
```

Now the scene can be changed to any desired view by changing the camera location. The light_source can be moved or additional sources added.

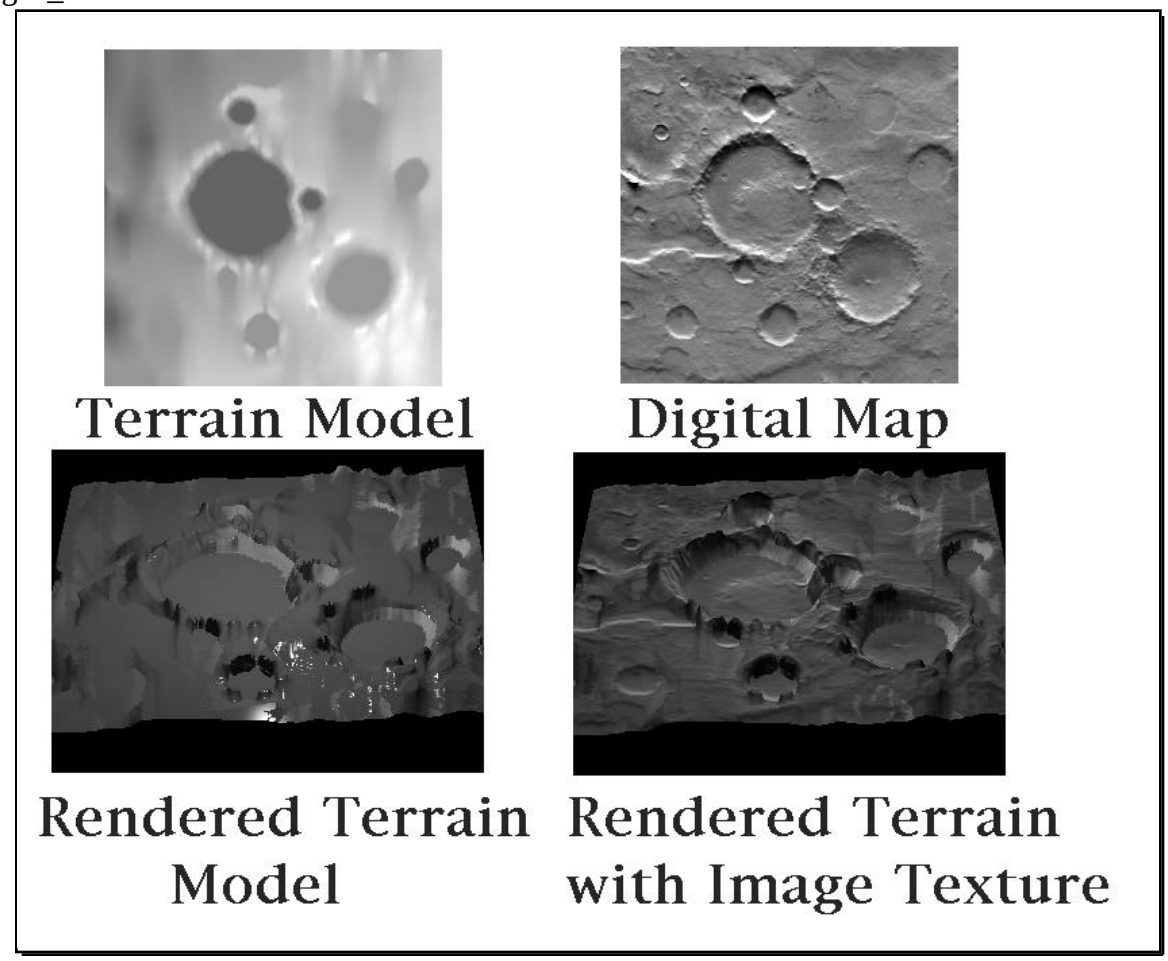

Figure 1. DTM, MDIM and rendered view of the scene.

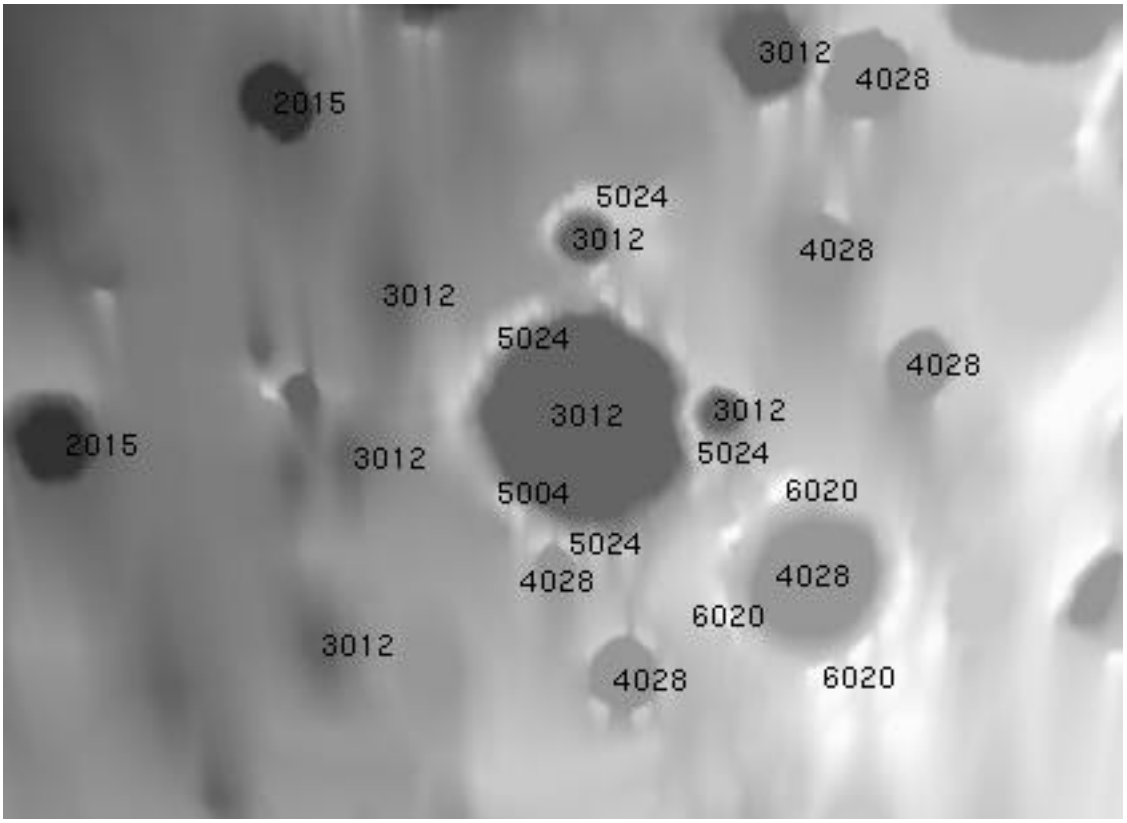

Figure 2. Elevation values for this scene.